

**DRAFT**  
**SUPPLEMENTAL ENVIRONMENTAL  
IMPACT STATEMENT**

**PHIPPS OCEAN PARK BEACH RESTORATION PROJECT  
TOWN OF PALM BEACH,  
PALM BEACH COUNTY, FLORIDA**

**JULY 2002**

**Prepared for:**

**Town of Palm Beach  
Palm Beach County, Florida**

**and**

**U.S. Army Corps of Engineers  
Jacksonville District**



**US Army Corps of Engineers  
Jacksonville District**



**Prepared by:**  
**Coastal Technology Corporation**

**and**



**Dial Cordy and Associates Inc.**

DRAFT

# **SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT**

JULY 2002

---

## **Regulatory Authorization Clean Water Act Section 404 and Rivers and Harbors Act Section 10**

### **PHIPPS OCEAN PARK BEACH RESTORATION PROJECT TOWN OF PALM BEACH, PALM BEACH COUNTY, FLORIDA**

**LEAD AGENCY:** Jacksonville District, U.S. Army Corps of Engineers

**COOPERATING AGENCIES:** Town of Palm Beach, Florida (permit applicant), Florida Department of Environmental Protection, U.S. Environmental Protection Agency, National Marine Fisheries Service, U.S. Fish & Wildlife Service.

This Draft Supplemental Environmental Impact Statement (DSEIS) describes the selected plan and the alternatives evaluated to provide shore protection for the shoreline surrounding Phipps Ocean Park within the Town of Palm Beach, Florida. The recommended plan is intended to: (1) mitigate the long-term erosion impacts of Lake Worth Inlet and armored coastline north of the Project area; (2) provide and maintain storm protection to upland improvements; (3) restore and maintain the beach for public recreational use; and (4) restore and maintain the beach for marine turtle nesting habitat. The plan includes placement of approximately 1.5 million cubic yards of fill over approximately 1.9 miles of beach, between DEP Monuments R-116 and R-126 and installation of 3.1 acres of hardbottom reef. Sand compatible with the existing beach will be obtained from borrow areas located approximately 3,500 feet offshore and between 1.5 and 2.6 miles south of the fill. Geotechnical analysis of the borrow area indicates that the material is suitable for the restoration of Phipps Ocean Park beach and suitable for use by nesting sea turtles and subsequent hatching success. The borrow areas have been designed with buffer zones to avoid impact to hardbottom communities in the vicinity of the borrow areas. Mitigation of hardbottom resources within the fill area is required and has been incorporated into the plan.

For more information, contact Dale Beter, SEIS Team Leader,  
U.S. Army Corps of Engineers, Regulatory Branch, 400 North Congress Avenue, Suite 130,  
West Palm Beach, Florida 33401; phone (561) 686-3441 or facsimile  
561-683-4941. Additional comments must be received by [date].



**U.S. Army Corps of Engineers  
Jacksonville District**

## **EXECUTIVE SUMMARY**

### **DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT**

#### **REGULATORY AUTHORIZATION COE SECTION 10 AND SECTION 404 PERMITS**

#### **PHIPPS OCEAN PARK BEACH RESTORATION PROJECT TOWN OF PALM BEACH, PALM BEACH COUNTY, FLORIDA**

Project Description. The Phipps Ocean Park Beach Restoration Project (Project) entails the placement of 1.5 million cubic yards of sand to restore 1.9 miles of beach within the Town of Palm Beach immediately south of Sloan's Curve, with construction of an artificial reef proposed as mitigation for unavoidable impacts to nearshore hardbottom. The fill area extends between Department of Environmental Protection (DEP) Monuments R-116 and R-126.

The fill design profile includes a constructed berm width of approximately 140 to 330 feet with a dry beach width (distance to the MHW) of approximately 198 to 380 feet. The projected toe of fill extends approximately 280 to 540 feet offshore and will unavoidably impact approximately 3.1 acres of nearshore hardbottom located immediately adjacent to the shoreline. Fill is proposed to be obtained from two offshore borrow areas located approximately 3,500' offshore and between 1.5 and 2.6 miles south of the fill area. Fill will be transferred from the borrow areas to the fill area by hydraulic dredge; construction by hopper dredge will not be allowed to avoid impacts to hardbottom biological communities in the vicinity of the borrow areas.

Need or Opportunity. The Project is located on the southeast Florida coast within Palm Beach County. The proposed work is consistent with the *"Comprehensive Coastal Management Plan Update - Palm Beach Island, Florida"* (June 1998) and the *"Coast of Florida, Erosion and Storm Effects Study - Region III, with Final Environmental Impact Statement, U.S. Army Corps of Engineers, Jacksonville District"*, October 1996. The Project is needed to mitigate the long-term erosion impacts of Lake Worth Inlet and the erosion impacts of the armored coastline north of the Project area, provide and maintain storm protection to upland improvements, restore and maintain the beach for public recreational use, and to restore and maintain the beach for marine turtle nesting habitat.

The Florida Department of Environmental Protection (FDEP) has designated all of the Project area from R-116 to R-126 as an area of "critical erosion." This designation is based on (a) the

erosion attributable to the influence of Lake Worth Inlet and the adjacent armored shoreline and (b) the existing headland features surrounding the Project area.

Shoreline conditions and structures updrift of the Project area exacerbate erosion and, if action is not taken, will lead to significant future erosion of the Project area and the shoreline further south. Net longshore sand transport in the region is to the south. Construction of the Inlet and Inlet jetties interrupts the longshore flow of sand and sand starves the region south of the Inlet leading to the construction of seawalls, groins, and eventually a rock revetment constructed by the Florida Department of Transportation (FDOT) north of Sloan's Curve in 1987. The revetment has cut-off the sand supply from the dune landward of the revetment. These conditions are expected to continue to contribute to the erosion within the Project area in the future.

The three miles of shoreline immediately north of Sloan's Curve are fronted by numerous armoring structures including rock revetments, seawalls, and groins. The existing groins north of Phipps Ocean Park deter southerly longshore transport to Phipps Ocean Park and the Project area. The Mid-Town Beach Restoration Project is located to the north of this three-mile segment; the groins and armoring have impeded the southerly migration of the Mid-Town sand. In combination with the effects of Lake Worth Inlet, armoring structures have caused a longshore transport and sediment deficit to the Project area, resulting in erosion, loss of the recreational beach, increase in the storm damage risk to upland property, and loss of sea turtle nesting habitat.

Major Findings and Conclusions. The proposed action is in the national interest and can be constructed while protecting the human environment from unacceptable impacts. Benefits of the proposed action would be to mitigate the long-term erosion impacts of the Inlet and the erosion impacts of armored coastline north of the Project area, provide and maintain storm protection to upland improvements, restore and maintain the beach for public recreational use, and to restore and maintain the beach for marine turtle nesting habitat. The primary adverse impact of concern is the potential impact to hardbottom resources, particularly to ephemeral intermittently exposed nearshore hardbottom features in the fill area. Other adverse impacts include increased turbidity and sedimentation in the vicinity of the borrow sites (including reefs in the vicinity of the borrow areas) during construction, increased sedimentation and turbidity along the nearshore environment during construction and potential impacts on hardbottom habitat for managed fish species. Measures taken to avoid, minimize, and compensate for adverse impacts include reducing the fill placement area to avoid nearshore hardbottom resources, use of buffer zones and strict construction vessel control requirements to avoid and minimize impact to hardbottom resources in the vicinity of the borrow areas, and installation of a 3.1 acre mitigation reef in water depths ranging from -5 feet to -13 feet north of the Project area. Specific mitigation measures associated with the dredging operations include no anchoring within 200 feet of the offshore hardbottom, no dredging within 400 feet to 524 feet east of the westerly limits of the offshore hardbottom, delineation of the borrow area with lighted buoys, use of a real time geo-positioning system on the dredge, diver assisted dredge anchor placement during day light hours only, monitoring of turbidity and sedimentation, use of manatee observers, and sea turtle monitoring.

Alternatives. Alternative plans evaluated in the SEIS include, (1) the “No-Action” Alternative, (2) beach nourishment and periodic renourishment in combination with groin structures, and (3) beach nourishment with periodic renourishment. Alternative sand sources considered include offshore borrow areas located approximately 3,500 feet offshore and between 1.5 and 2.6 miles south of the fill area mid-point, deepwater sand sources, upland sand sources, foreign sand sources, and sand from maintenance dredging of adjacent inlet ebb and flood shoals.

Preferred Alternative. The Preferred Alternative includes a combination of beach nourishment with periodic renourishment and construction of a 3.1 acre mitigation reef. The optimum plan for improvement consists of placement of 1.5 million cubic yards of sand over 1.9 miles of beach immediately south of Sloan’s Curve between DEP Monuments R-116 to R-126. The optimum design profile includes a construction berm width of approximately 140 to 330 feet with a dry beach width (distance to the MHW) of approximately 190 to 380 feet. The projected toe of fill extends approximately 280 to 540 feet offshore. The preferred mitigation reef structure will best provide for the “like-kind” mitigation of the existing hardbottom impacted by the Project and accommodate species that use the impacted hardbottom.

Issues Raised by the Public and Agencies. In addition to the potential adverse impacts identified in the “Major Findings and Conclusions” statement above, some agencies and public commenters raised other concerns during the scoping process. Generally, the additional concerns related to the quantification of hardbottom resources in the vicinity of the Project, the functions and values of hardbottom features, potential secondary and cumulative effects of beach nourishment projects on hardbottom resources in the vicinity of the Project, impacts to essential fish habitat, potential of hardbottom in the borrow area dredge limits, and potential public safety concerns associated with the nearshore or shallow hardbottom mitigation reefs. Residents expressed concern with the extent of shoreline erosion, the threat of erosion to upland property and infrastructure, and the “No-Action” Alternative.

Areas of Controversy. The most significant area of controversy, as evaluated in this SEIS, concerns the functions and values of nearshore hardbottom features, the immediate and long-term impact of burying nearshore hardbottom in the fill area, and the effectiveness of the mitigation to compensate for the resource impacts of the Project.

Unresolved issues. At the time the preliminary draft SEIS was prepared, the extent, location, and quantity of mitigation reef necessary to offset impacts to nearshore hardbottom impacts had not been fully resolved. This issue is evaluated in Section 4.7, Hardbottom Resources.

## TABLE OF CONTENTS

|   | Page |
|---|------|
| EXECUTIVE SUMMARY .....   | III  |
| LIST OF APPENDICES .....  | XII  |
| LIST OF FIGURES.....  | XIII |
| LIST OF TABLES .....  | XV   |
| 1.0 PROJECT PURPOSE AND NEED .....                                | 1    |
| 1.1 Project Purpose and Agency Goal .....                         | 1    |
| 1.2 Project Need.....   | 1    |
| 1.3 Proposed Action.....  | 4    |
| 1.4 Project Authority.....  | 7    |
| 1.4.1 Initial Authorization.....                                  | 7    |
| 1.4.2 Supplemental Information .....                              | 7    |
| 1.5 Project Location .....  | 9    |
| 1.6 Project History .....   | 9    |
| 1.7 Related Environmental Documents .....                         | 10   |
| 1.8 Decisions to be Made.....                                     | 11   |
| 1.9 Scoping and Issues.....                                       | 11   |
| 1.9.1 Issues Evaluated in Detail .....                            | 12   |
| 1.9.2. Impact Measurement.....                                    | 12   |
| 1.9.2.1 Hardbottom and Reef Impacts .....                         | 12   |
| 1.9.2.2 Nesting Sea Turtles and Impacts to Foraging Habitat ..... | 13   |
| 1.9.2.3 Impact to Public Recreational Opportunities .....         | 13   |
| 1.9.2.4 Impact on Upland Property .....                           | 13   |
| 1.9.2.5 Sediment Budget Restoration .....                         | 14   |
| 1.9.2.6 Impact on Public Safety .....                             | 14   |
| 1.9.2.7 Other Impacts.....  | 14   |
| 1.9.3 Issues Eliminated From Detailed Analysis .....              | 14   |
| 1.10 Permits, Licenses, and Entitlements .....                    | 15   |
| 2.0 PROJECT ALTERNATIVES .....                                    | 17   |
| 2.1. Description of Alternatives Evaluated in Detail .....        | 17   |

|         |  |    |
|---------|--|----|
| 2.1.1   | Alternative 1 - "No-Action" Alternative .....  | 18 |
| 2.1.2   | Alternative 2 – Beach Fill with Structures.....  | 20 |
| 2.1.3   | Alternative 3 - Beach Fill with Periodic Renourishment (Preferred) .....   | 21 |
| 2.1.4   | Sand Source Alternatives Analysis .....  | 24 |
| 2.1.4.1 | Offshore Borrow Areas (preferred).....   | 24 |
| 2.1.4.2 | Deep Water Sand Sources.....   | 26 |
| 2.1.4.3 | Upland Sand Sources .....  | 29 |
| 2.1.4.4 | Foreign Sand Sources .....   | 30 |
| 2.1.4.5 | Inlet By-Pass Sand Sources.....  | 31 |
| 2.2     | Issues and Basis for Choice .....  | 32 |
| 2.2.1   | Project Alternatives.....  | 32 |
| 2.2.2   | Sand Source Alternatives.....  | 32 |
| 2.3     | Alternatives Eliminated From Detailed Evaluation.....  | 32 |
| 2.3.1   | Alternative 4 - Increased Fill Area Design (Placement of additional 343,200 cubic yards between R-114 to R-116): ..... | 32 |
| 2.3.2   | Alternative 5 - Reduced Fill Area Design (Placement of 0.75 - 1.5 million cubic yards between R-116 to R-121).....     | 35 |
| 2.3.3   | Alternative 6 - Revetment.....   | 37 |
| 2.3.4   | Alternative 7 - Seawalls.....  | 37 |
| 2.3.5   | Alternative 8 - Nearshore Berm.....  | 37 |
| 2.3.6   | Alternative 9 - PEP Reef.....  | 38 |
| 2.3.7   | Alternative 10 - Groin Field Without Beach Nourishment.....  | 38 |
| 2.3.8   | Alternative 11 - Modification of the Lake Worth Inlet Sand Transfer Plant.....   | 38 |
| 2.3.9   | Alternative 12 - Dune Restoration .....  | 39 |
| 2.3.10  | Alternative 13 - Navigation Project Modification or Abandonment .....  | 40 |
| 2.3.11  | Alternative 14 - Beach Fill with Periodic Nourishment Stabilized by an Offshore Breakwater .....                       | 40 |
| 2.3.12  | Alternative 15 - Beach Fill with Periodic Nourishment and Hurricane Surge Protection Berm .....                        | 40 |
| 2.3.13  | Alternative 16 - Feeder Beach .....  | 41 |
| 2.4     | Alternatives Not Within Jurisdiction of the Lead Agency.....   | 41 |
| 2.4.1   | Rezoning of Beach Area .....   | 41 |
| 2.4.2   | Modification of Building Codes .....   | 41 |
| 2.4.3   | Construction Setback Line.....   | 41 |
| 2.4.4   | Construction Moratorium or No Growth Program .....   | 42 |
| 2.4.5   | Evacuation Planning .....  | 42 |
| 2.4.6   | Condemnation of Land and Structures .....  | 42 |

|  |    |
|--|----|
| 2.4.7 Relocation or Retrofit of Structures.....                    | 42 |
| 2.5 Comparison of Alternatives .....                               | 43 |
| 2.6 Mitigation.....  | 46 |
| 3.0 AFFECTED ENVIRONMENT .....                                     | 47 |
| 3.1 Coastal Environment.....                                       | 47 |
| 3.1.1 Tides.....   | 49 |
| 3.1.2 Storm Surges.....  | 49 |
| 3.1.3 Currents.....  | 50 |
| 3.1.4 Waves.....   | 50 |
| 3.2 Beach and Inlet Geomorphology .....                            | 50 |
| 3.2.1 Geomorphic Setting of Palm Beach Island.....                 | 51 |
| 3.2.2 Lake Worth Inlet Sediment Budget .....                       | 52 |
| 3.2.3 Palm Beach Island - Shoreline and Volumetric Changes .....   | 57 |
| 3.3 Sediment Characteristics of Borrow Area and Native Beach ..... | 73 |
| 3.3.1 Sand Quality.....  | 73 |
| 3.3.2 Composition and Mineralogy .....                             | 74 |
| 3.3.3 Color .....  | 74 |
| 3.4 Beach and Dune Vegetation and Wildlife.....                    | 75 |
| 3.5 Threatened and Endangered Species.....                         | 75 |
| 3.5.1 Sea Turtles .....  | 75 |
| 3.5.1.1 Nesting Habitat .....                                      | 76 |
| 3.5.1.1.1 Loggerhead Sea Turtle .....                              | 76 |
| 3.5.1.1.2 Green Sea Turtle .....                                   | 76 |
| 3.5.1.1.3 Leatherback Sea Turtle .....                             | 76 |
| 3.5.1.2 Nearshore Foraging and Offshore Habitat Utilization .....  | 76 |
| 3.5.1.2.1 Loggerhead Sea Turtle .....                              | 77 |
| 3.5.1.2.2 Green Sea Turtle .....                                   | 77 |
| 3.5.1.2.3 Leatherback Sea Turtle .....                             | 77 |
| 3.5.2 West Indian Manatee .....                                    | 78 |
| 3.5.3 Southeastern Beach Mouse .....                               | 78 |
| 3.5.4 Least Tern .....   | 78 |
| 3.5.5 Northern Right Whale.....                                    | 79 |
| 3.6 Offshore Borrow Area Resources .....                           | 79 |
| 3.7 Hardbottom Resources.....                                      | 80 |
| 3.7.1 Nearshore Hardbottom.....                                    | 82 |
| 3.7.2 Intermediate Hardbottom .....                                | 83 |



|       |  |    |
|-------|--|----|
| 3.7.3 | Offshore Hardbottom .....                                      | 84 |
| 3.8   | Beach and Sand Bottom Communities .....                        | 85 |
| 3.9   | Essential Fish Habitat .....                                   | 85 |
| 3.10  | Coastal Barrier Resources .....                                | 86 |
| 3.11  | Water Quality .....  | 86 |
| 3.12  | Hazardous, Toxic, And Radioactive Waste .....                  | 87 |
| 3.13  | Air Quality .....  | 87 |
| 3.14  | Noise .....  | 87 |
| 3.15  | Aesthetic Resources .....                                      | 87 |
| 3.16  | Recreation Resources .....                                     | 88 |
| 3.17  | Navigation .....   | 88 |
| 3.18  | Cultural Resources .....                                       | 88 |
| 4.0   | ENVIRONMENTAL CONSEQUENCES .....                               | 89 |
| 4.1   | Tides, Winds, Currents and Waves .....                         | 89 |
| 4.1.1 | Alternative 1 - No-Action .....                                | 89 |
| 4.1.2 | Alternative 2 - Beach Fill with Structures .....               | 89 |
| 4.1.3 | Alternative 3 – Beach Fill (Preferred Alternative) .....       | 89 |
| 4.2   | Beach and Inlet Geology and Geomorphology .....                | 90 |
| 4.2.1 | Alternative 1 - No-Action .....                                | 90 |
| 4.2.2 | Alternative 2 – Beach Fill with Structures .....               | 90 |
| 4.2.3 | Alternative 3 – Beach Fill (Preferred Alternative) .....       | 90 |
| 4.3   | Sediment Characteristics of Borrow Area and Native Beach ..... | 90 |
| 4.3.1 | No-Action .....  | 90 |
| 4.3.2 | Alternative 2 – Beach Fill with Structures .....               | 91 |
| 4.3.3 | Alternative 3 – Beach Fill (Preferred Alternative) .....       | 91 |
| 4.4   | Beach and Dune Vegetation and Wildlife .....                   | 91 |
| 4.4.1 | Alternative 1 - “No-Action” .....                              | 91 |
| 4.4.2 | Alternative 2 – Beach Fill with Structures .....               | 91 |
| 4.4.3 | Alternative 3 – Beach Fill (Preferred Alternative) .....       | 92 |
| 4.5   | Threatened and Endangered Species .....                        | 92 |
| 4.5.1 | Alternative 1 - “No-Action” .....                              | 92 |
| 4.5.2 | Alternative 2 – Beach Fill with Structures .....               | 93 |
| 4.5.3 | Alternative 3 – Beach Fill (Preferred Alternative) .....       | 93 |
| 4.6   | Offshore Borrow Area Resources .....                           | 94 |
| 4.6.1 | Alternative 1 - “No-Action” .....                              | 94 |
| 4.6.2 | Alternative 2 – Beach Fill with Structures .....               | 94 |

|        |   |     |
|--------|---|-----|
| 4.6.3  | Alternative 3 – Beach Fill (Preferred Alternative).....                             | 94  |
| 4.7    | Hardbottom Resources.....   | 95  |
| 4.7.1  | Alternative 1 - “No-Action”.....  | 95  |
| 4.7.2  | Alternative 2 – Beach Fill with Structures.....                                     | 95  |
| 4.7.3  | Alternative 3 – Beach Fill (Preferred Alternative).....                             | 95  |
| 4.8    | Essential Fish Habitat .....  | 96  |
| 4.8.1  | Alternative 1 - “No-Action”.....  | 96  |
| 4.8.2  | Alternative 2 – Beach Fill with Structures.....                                     | 96  |
| 4.8.3  | Alternative 3 – Beach Fill (Preferred Alternative).....                             | 96  |
| 4.9    | Coastal Barrier Resources.....  | 97  |
| 4.10   | Water Quality.....  | 97  |
| 4.11   | Hazardous, Toxic, and Radioactive Waste .....                                       | 98  |
| 4.12   | Air Quality .....   | 98  |
| 4.13   | Noise.....  | 98  |
| 4.14   | Aesthetic Resources.....  | 99  |
| 4.15   | Recreational Resources.....   | 99  |
| 4.16   | Cultural Resources.....   | 100 |
| 4.17   | Health and Safety.....  | 100 |
| 4.18   | Energy Requirements and Conservation.....   | 100 |
| 4.19   | Natural or Depletable Resources .....   | 100 |
| 4.20   | Cumulative Impacts .....  | 101 |
| 4.20.1 | Hardbottom Summary.....   | 101 |
| 4.20.2 | Sand Habitat Summary .....  | 103 |
| 4.20.3 | Significance of Cumulative Affects.....   | 103 |
| 4.21   | Irreversible and Irretrievable Commitment of Resources.....                         | 104 |
| 4.21.1 | Irreversible .....  | 104 |
| 4.21.2 | Irretrievable.....  | 104 |
| 4.22.  | Unavoidable Adverse Environmental Effects.....                                      | 104 |
| 4.23   | Local Short-Term Uses and Maintenance/Enhancement of Long-Term<br>Productivity..... | 105 |
| 4.24   | Conflicts and Controversy .....   | 105 |
| 4.25   | Uncertain, Unique, or Unknown Risks.....  | 105 |
| 4.26   | Precedent and Principle for Future Actions.....                                     | 106 |
| 4.27   | Environmental Commitments.....  | 106 |
| 4.28   | Compliance With Environmental Requirements .....                                    | 107 |
| 4.28.1 | National Environmental Policy Act of 1958.....                                      | 107 |
| 4.28.2 | Endangered Species Act .....  | 107 |

|         |  |     |
|---------|--|-----|
| 4.28.3  | Fish and Wildlife Coordination Act of 1958 .....                                   | 108 |
| 4.28.4  | National Historic Preservation Act of 1966 ( <i>inter alia</i> ) .....             | 108 |
| 4.28.5  | Clean Water Act of 1972 .....  | 108 |
| 4.28.6  | Clean Air Act of 1972.....   | 108 |
| 4.28.7  | Coastal Zone Management Act of 1972 .....  | 109 |
| 4.28.8  | Farmland Protection Policy Act of 1981.....  | 109 |
| 4.28.9  | Wild and Scenic River Act of 1968 .....  | 109 |
| 4.28.10 | Marine Mammal Protection Act of 1972 .....   | 109 |
| 4.28.11 | Estuary Protection Act of 1968.....  | 109 |
| 4.28.12 | Federal Water Project Recreation Act .....   | 109 |
| 4.28.13 | Fishery Conservation and Management Act of 1976.....                               | 110 |
| 4.28.14 | Submerged Lands Act of 1953.....   | 110 |
| 4.28.15 | Coastal Barrier Resources Act and Coastal Barrier Improvement Act<br>of 1990 ..... | 110 |
| 4.28.16 | Rivers and Harbor Act of 1899.....   | 110 |
| 4.28.17 | Anadromous Fish Conservation Act.....  | 110 |
| 4.28.18 | Migratory Bird Treaty Act and Migratory Bird Conservation Act .....                | 110 |
| 4.28.19 | Marine Protection, Research, and Sanctuaries Act.....                              | 110 |
| 4.28.20 | Magnuson-Stevens Fishery Conservation and Management Act .....                     | 111 |
| 4.28.21 | E.O. 11990, Protection of Wetlands .....   | 111 |
| 4.28.22 | E.O. 11988, Flood Plain Management.....  | 111 |
| 4.28.23 | E.O. 12898, Environmental Justice .....  | 111 |
| 4.28.24 | E.O. 13089, Coral Reef Protection .....  | 111 |
| 4.28.25 | E.O. 13112, Invasive Species .....   | 111 |
| 5.0     | LIST OF PREPARERS .....  | 113 |
| 6.0     | PUBLIC INVOLVEMENT .....   | 115 |
| 6.1     | Scoping and Draft SEIS .....   | 115 |
| 6.2     | Agency Coordination .....  | 115 |
| 6.3     | List Of Statement Recipients (Draft SEIS) .....                                    | 115 |
| 6.4     | Comments Received and Response .....   | 115 |
| 6.5     | Circulation of Final SEIS.....   | 116 |
| 7.0     | REFERENCES .....   | 117 |
| 8.0     | INDEX.....   | 123 |

## **LIST OF APPENDICES**

|            |   |
|------------|---|
| Appendix A | Coastal Zone Management Consistency                       |
| Appendix B | Pertinent Correspondence                                  |
| Appendix C | Cumulative Impact Assessment Report                       |
| Appendix D | EFH Assessment Report                                     |
| Appendix E | Mitigation Reef Plan and Monitoring Program               |
| Appendix F | Physical and Biological Monitoring Program                |
| Appendix G | Vessel Operations Plan                                    |
| Appendix H | Borrow Area Hardbottom Survey Report                      |
| Appendix I | Lake Worth Inlet Management Study and Implementation Plan |

## LIST OF FIGURES

|   | Page   |
|---|--------|
| Figure 1. 1 Preferred Alternative .....   | 5      |
| Figure 1. 2 Profiles - Fill Template.....   | 6      |
| Figure 1. 3 Location Map, Lake Worth Inlet to South Lake Worth Inlet .....                            | 8      |
| <br>Figure 2. 1 "No-Action" - No Uniform Existing Hardbottom R-121 to R-123 .....                     | <br>18 |
| Figure 2. 2 "No-Action" - Assumed Uniform Hardbottom R-121 to R-123 .....                             | 19     |
| Figure 2. 3 Beach Fill Design with Structures .....   | 21     |
| Figure 2. 4 Beach Fill Performance at Six Years.....  | 22     |
| Figure 2. 5 Beach Fill Performance After Eight Years .....  | 23     |
| Figure 2. 6 Seven Potential Offshore Borrow Areas .....   | 25     |
| Figure 2. 7 Borrow Area III .....   | 27     |
| Figure 2. 8 Borrow Area IV .....  | 28     |
| Figure 2. 9 Increased Fill Area Design .....  | 34     |
| Figure 2. 10 Reduced Fill Area Design.....  | 36     |
| <br>Figure 3. 1 Plan View - Lake Worth Inlet to South Lake Worth Inlet.....                           | <br>48 |
| Figure 3. 2 Shallow Water Wave Data for Station 158 Adjacent to Palm Beach, FL .....                  | 50     |
| Figure 3. 3 The Floridian Plateau .....   | 51     |
| Figure 3. 4 Lake Worth Inlet Sediment Budget Cells and Domain .....                                   | 52     |
| Figure 3. 5 Mean High Water Line Change Rates (ft/yr).....  | 59     |
| Figure 3. 6 Volume Change Rates (cy/yr).....  | 61     |
| Figure 3. 7 Aerial Photograph South of Lake Worth Inlet (Reach 1) (March 2001).....                   | 64     |
| Figure 3. 8 Aerial Photograph of Reach 2 at Palm Beach Country Club ( March 2001).....                | 65     |
| Figure 3. 9 The Narrow Beach Front Along Reach 2 at Palm Beach Country Club<br>(February 2002). ..... | <br>65 |
| Figure 3. 10 Aerial Photograph of Reach 3 at Breakers Hotel (March 2001).....                         | 65     |
| Figure 3. 11 The Mid-Town Region of Reach 4 (February 2002).....                                      | 66     |

|              |   |    |
|--------------|---|----|
| Figure 3. 12 | Aerial Photograph of Reach 5 at Widener's Curve (March 2001).....   | 66 |
| Figure 3. 13 | Rock and Groins in Reach 6 (February 2001).....   | 67 |
| Figure 3. 14 | Exposed Anastasia Formation in Reach 7 .....  | 67 |
| Figure 3. 15 | Oblique Aerial Photograph of the Concave Shoreline in Reach 7 (1999).....   | 68 |
| Figure 3. 16 | Lake Worth Public Beach, Immediately South of Lake Worth Pier (Reach 8)..   | 69 |
| Figure 3. 17 | Exposed Seawall Near R-135 (Reach 8) .....  | 69 |
| Figure 3. 18 | Typical Beach and Seawall Conditions Near R-143 Along Reaches 9 & 10 .....  | 69 |
| Figure 3. 19 | South Lake Worth Inlet (Reach 11).....  | 70 |
| Figure 3. 20 | Example of Nearshore Hardbottom Habitat Captured from Towed Video<br>Survey Near FDEP Monument R-91 .....   | 82 |
| Figure 3. 21 | Close-Up Photograph of Nnearshore Algal Fouling Community Shown in<br>Figure 3.20.....  | 82 |
| Figure 3. 22 | Example of Intermediate Depth Hardbottom Habitat Captured From Towed<br>Video Survey Near FDEP Monument R-103. Habitat Dominated by Low to<br>Medium Profile Gorgonians and Sponges ..... | 83 |
| Figure 3. 23 | Photograph of Offshore Hardbottom Habitat Near Breakers Reef. Note High<br>Diversity and Adult Fish Populations.....  | 84 |

## LIST OF TABLES

|  | Page |
|--|------|
| Table 1. 1 Properties with Seawalls in Project Vicinity Expected to Benefit by Project .....   | 3    |
| Table 1. 2 Recreational Use of Phipps Ocean Park (1993 and 1999).....  | 3    |
| Table 2. 1 Alternative 4 - Increased Fill Design Characteristics .....   | 33   |
| Table 2. 2 Major Features and Direct and Indirect Impacts of the Proposed Action and<br>Other Alternatives.....  | 43   |
| Table 3. 1 Predicted Peak Storm Surge (ft MSL) .....   | 49   |
| Table 3. 2 Lake Worth Inlet Sediment Budget - 1974 to 1994 and 1994 to 2000 .....  | 54   |
| Table 3. 3 Inlet Sediment Sinks and Mechanical Transfer - 1974 to 1994.....  | 56   |
| Table 3. 4 Inlet Sediment Sinks and Mechanical Transfer - 1994 to 2000.....  | 56   |
| Table 3. 5 Palm Beach Island Reaches .....   | 58   |
| Table 3. 6 Shoreline (MHWL) Change Rates From 1928-1974, 1974-1990, and<br>1990-2000 .....   | 60   |
| Table 3. 7 Volume Change Rates From 1974-1990 and 1990-1997 .....  | 62   |
| Table 3. 8 Volume Change Rates From 1929-1957, 1957-1979 .....   | 63   |
| Table 3. 9 Summary of Net Volume Change Rates .....  | 71   |
| Table 3. 10 Summary of Historical Nourishment Volumes - Reaches 2-11.....  | 71   |
| Table 3. 11 Summary of Historical Erosion Volumes .....  | 72   |
| Table 3. 12 Native Beach and Borrow Areas Grain Size Characteristics .....   | 73   |
| Table 3. 13 Provisional Classification of Nearshore Hardbottom Habitat on the Inner Shelf<br>of Palm Beach County .....  | 81   |
| Table 3. 14 Essential Fish Habitat Areas .....   | 85   |
| Table 4. 1 Summary of Past, Present, and Proposed Future Projects and Direct Hardbottom<br>Impacts Within Lake Worth Inlet to South Lake Worth Inlet Region..... | 102  |